Laboratory equipment having drain grooves on a worktop

The invention relates to a laboratory equipment in accordance with the preamble to Patent Claim 1.

A laboratory equipment of this kind is used, for example, in the operation of a preparative high-pressure liquid chromatography (HPLC) apparatus in the research laboratory, in which, for example, flow rates of up to 100 ml/min and more are commonly encountered. The fluids used for this purpose are usually readily volatile organic solvents, which can have a toxic and explosive effect.

A worktop for a laboratory bench, which consists of mutually connected worktop components, is previously disclosed in the Patent Abstracts of Japan under publication number 01 119 347 A.

Previously disclosed in EP 0 233 803 A1 is a laboratory bench with a channel, through which electrical connection cables and system lines are routed.

Described in AU 39 831/93 B is a laboratory equipment, which exhibits three mutually connected service towers, in conjunction with which at least one movable bench extends next to one lateral edge of the base unit connecting the towers together.

Previously disclosed in EP 1 106 254 A2 is a device for the disposal of liquid waste substances at a laboratory workstation. This device exhibits a receiving container, which is allocated to the laboratory workstation and/or a laboratory workbench and has an inlet for the waste substances, an extraction connection and a ventilation termination. This device also has collecting containers arranged on a trolley.

A laboratory bench, which is of mobile execution and exhibits a worktop and a storage space, is provided in the supply and workstation arrangement previously

disclosed in DE 202 14 490 U1. This arrangement also includes a supply device, which is accommodated in the storage space of the laboratory bench.

A laboratory equipment in accordance with the preamble to Patent Claim 1 is previously disclosed, for example, in US 3 041 957. In this equipment, the worktop has a basin-like drain channel, which is connected to a refuse tank. The refuse tank is accommodated in a cabinet-like base unit of the mobile laboratory bench executed as a trolley. Situated on the worktop is an extractor hood, which is connected to an exhaust air system that is routed partially through the base unit of the mobile laboratory bench.

Problems can always arise in conjunction with the aforementioned state of the art if a fluid, in particular an organic solvent, leaks or overflows on the worktop.

The object of the invention is to make available a laboratory equipment of the aforementioned nature, which is capable of being operated more safely.

This object is achieved in accordance with the invention by means of a laboratory equipment having the characteristics of Patent Claim 1.

Advantageous further developments are the subject of the dependent Claims.

The at least one worktop of the laboratory equipment in accordance with the invention exhibits a plurality of drain grooves provided on its upper surface, which are connected to the at least one drain channel. In this way, any leaking solvent is unable to spread over the entire worktop, but only as far as the next drain groove. The safety of the laboratory equipment in accordance with the invention is thereby considerably increased, as the leaking or overflowing solvent is to some extent highly volatile and toxic. If the solvent were able to spread over a larger area, more solvent would actually evaporate. The fact that it flows into the grooves, however, means that it is only able to spread over a relatively limited part of the worktop.

The drain grooves are advantageously executed and arranged so that they are distributed over the surface in such a way that a segment-like subdivision results for

the at least one worktop, in conjunction with which the drain grooves are preferably also provided at the periphery of the at least one worktop. As already indicated, any leaking or overflowing solvent is ultimately able in this way to spread over only a single segment of the worktop, which is separated by drain grooves from the following segment. Moreover, a drain groove positioned around the periphery of the worktop in each case prevents the solvent from flowing over the edge of the worktop, for example over a bench edge, so that no solvent is able to leave the worktop and drip down. The escaping solvent thus arrives relatively quickly in the area of the drain grooves, where it can flow away in a controlled fashion. A smaller quantity of solvent will evaporate as a result, which improves the safety in the laboratory.

According to one further development of the invention, the at least one drain channel is situated more or less at the centre of the at least one worktop, in conjunction with which a drainage line preferably made of Teflon is connected to the at least one drain channel, which drainage line is preferably routed rearwards below the at least one worktop, and then vertically downwards and to a refuse tank. The escaping fluid, which, as previously mentioned, is most often an organic solvent in the applications that are of primary interest here, thus makes its way rapidly via the drain grooves and the at least one drain channel into an enclosed space, so that the smallest possible quantity of solvent is able to pass into the atmospheric environment of the laboratory equipment. The routing of the drainage line rearwards and then vertically downwards permits the storage space provided below the worktop to be used for other purposes. The laboratory equipment in accordance with the invention can accordingly also be constructed with extremely compact dimensions.

In accordance with one further development of the invention, a plurality of drain channels per worktop is situated in each case preferably more or less at the centre of the and on the rear edge of the worktop. In the at least one worktop, internally situated drain holes running from the centre rearwards convey the draining solvent rearwards in a horizontal direction. The drain channels for these drain holes are preferably situated at the points of intersection of the drain grooves with the drain holes in the at least one worktop. On the rear edge of the at least one worktop, the drain holes are connected initially with a horizontally running collecting line made

from an inert plastic, such as Teflon, which is connected to the refuse tank via a drain channel routed vertically downwards.

In accordance with a particularly preferred further development, the drain grooves are inclined towards the at least one drain channel. In this way, any fluid present in the drain grooves remains there only for a short time, so that only a little time is available for evaporation of the fluid. On the contrary, the fluid flows away rapidly and can be collected in the aforementioned refuse tank.

In accordance with another further development of the invention, a ventilated laboratory cabinet for fluid containers, preferably solvent containers, is present beneath the at least one worktop, in conjunction with which the laboratory cabinet is preferably constructed from a non-combustible material and exhibits an earthed floor made of stainless steel sheet. A further source of solvent vapours, namely the area in which the refuse tank is situated, for example, is also ventilated in this way, that is to say it is connected to an exhaust air system. This further development also improves the safety of the laboratory equipment in accordance with the invention, since fewer readily explosive vapours or gases are able to form in the aforementioned area. Similar embodiments are also applicable for toxic gases or vapours.

An extractor hood is advantageously provided on the at least one worktop. It is possible in this way to connect a further source of solvent vapours to the exhaust air system. It is clear that the exhaust air lines of the aforementioned laboratory cabinet or cabinets for solvent containers can be routed together with those of the extractor hood, so that ultimately only a single exhaust air system, albeit with a plurality of branches, is required.

In accordance with one advantageous further development, a safety device is provided in addition, which triggers an alarm in the event that a fluid flows through the drain grooves. As previously mentioned, the fluid may be in particular an organic solvent. The triggering of an alarm can interrupt the entire power supply to the laboratory equipment, for example, thereby preventing an uncontrolled solvent leak, should the threat present itself. The laboratory equipment in accordance with the invention can thus also be operated completely automatically. What we are

concerned with here is a leak-proof platform, on which systems are able to operate in a condition without the need for human supervision, since the supervision is performed automatically, for example by electronic means. What is achieved with this further development, therefore, is that larger quantities of explosive solvent vapours, for example, are not able to form or collect in the first place, since the evaporation of larger quantities is already prevented.

In another further development of the invention, the at least one worktop is part of a mobile laboratory trolley, which preferably exhibits one upper and one lower worktop as well as a floor, for example in the form of a low-level supporting construction to receive the laboratory cabinet. As a result of this, such a laboratory equipment is highly mobile and accessible from all sides. It is able to improve operating safety, where this also necessary in the case of locally changing workplaces. Through the provision of the floor in the form of a special, low-level supporting construction to receive one or a plurality of cabinets for solvent containers, the latter are arranged as close to the floor as possible, so that these as a rule heavy containers do not require to be lifted completely, but only require to be tipped, in order to enable them to be pushed into the cabinet base unit. The accessibility of the fluids and in particular the solvent containers is improved in this way, and their ease of handling is facilitated.

The at least one worktop is preferably assembled from a plurality of, and advantageously from three, part surfaces, in conjunction with which each part surface preferably exhibits one drain channel and a plurality of drain grooves. The parts of a worktop are thus capable of being transported more easily to the assembly site for the laboratory trolley.

Illustrative embodiments of the subject of the invention are described below in greater detail with reference to the drawing, in conjunction with which all characteristics that are described and/or figuratively represented individually or in any desired combination constitute the subject of the present invention regardless of their inclusion in the Claims or their relationship. In the drawing:

Fig. 1 shows a schematic, perspective front view of a laboratory equipment;

Fig. 2 shows a schematic front view of a part of the laboratory equipment;

Fig. 3 shows a schematic top view of a part of the laboratory equipment;

Fig. 4 shows a schematic top view of a worktop of the laboratory equipment; and

Fig. 5 shows a schematic section along line V-V in Fig. 4.

A perspective front view of a laboratory equipment 1 is illustrated schematically in Fig. 1. The laboratory equipment 1 generally has at least one worktop 3 exhibiting at least one drain channel 2. In the embodiment illustrated in Fig. 1, the at least one worktop 3 is part of a mobile laboratory trolley 4, which exhibits an upper worktop 3 and a lower worktop 5 arranged beneath it as well as a floor 6 in the form of a low-level supporting construction.

Advantageously, the upper and/or the lower worktop 3, 5 is subdivided in each case, in the interests of easier transportability, into part areas 27, in conjunction with which each part area 27 can exhibit one or more drain channels 2 and an enclosing drain groove 10, so that no solvent is able to escape via a part area. One embodiment with three part areas 27 is illustrated schematically in Fig. 4, in conjunction with which each part area 27 exhibits four segment-like subdivisions 11.

Detectors, such as a mass spectrometer or a UV spectrometer, as well as chromatography columns or an extractor hood 7, as illustrated in Fig. 1, can be positioned on the upper worktop 3, for example, beneath which sample injectors or fraction collectors can be arranged. A second device level is present in this respect on the subjacent lower worktop 5, on which preferably pumps or flat components for the system, for example a safety device 22 of the kind described below, can be accommodated.

In accordance with the invention, the at least one worktop 3 exhibits a plurality of drain grooves 9, 10 provided on its surface 8, which are connected to the at least one

drain channel 2. The drain grooves 9 run in accordance with Fig. 1 transversely to the longitudinal axis of the laboratory trolley 4, whereas the drain grooves 10 in accordance with Fig. 3 extend in the longitudinal direction of the laboratory trolley. The latter are omitted from Fig. 1 in the interests of greater clarity.

Since, in the end, two worktops 3, 5 arranged superimposed and parallel with one another are provided in accordance with Fig. 2, each of these worktops has the drain grooves 9, 10 connected with the at least one drain channel 2 in each case.

It can be appreciated from Fig. 1 and particularly advantageously from Fig. 3, which shows a schematic top view of the laboratory equipment 1, that the drain grooves 9, 10 are executed and arranged over the surface 8 in such a way that a segment-like subdivision 11, already mentioned previously in conjunction with the part surfaces 27, results for the worktops 3, 5 in each case. The drain grooves 9, 10 are also provided on the periphery 26 of each worktop 3, 5 in conjunction with this, as can be appreciated from Fig. 3; here they form a groove surrounding the working area in each case.

The drain channels 2 are situated in accordance with a first embodiment at the centre or more or less at the centre of each worktop 3, 5 and are illustrated only schematically in Fig. 1. A drainage line 12 (see Fig. 2) is connected to the drain channel 2 in each case, which line is preferably made of Teflon. Each drainage line 12 is routed rearwards below the worktop 3, 5 in each case, and then vertically downwards and to a refuse tank 13 represented schematically in Fig. 2. In conjunction with this, Fig. 2 illustrates a schematic, partial front view of the laboratory equipment 1.

In accordance with a preferred embodiment of the invention, the at least one worktop 3, 5 has a plurality of drain channels 2, which are preferably arranged in each drain groove 9 running transversely to the longitudinal axis of the at least one work top 3, 5 and in the rearmost drain groove 10. In addition, the at least one worktop exhibits in its interior preferably a plurality of drain holes 28 running horizontally rearwards and attached to the at least one drain channel 2 of a drain groove 9, 10. Present in these drain holes 28, which are drilled horizontally into the worktop 3, 5 and run horizontally

towards the rear, are the one or more drain channels 2 at or in the vicinity of intersection points 29 between the drain hole 28 and the drain grooves 9 in each case, more or less at the centre, and the rearmost drain groove 10. In the interests of greater clarity, only one drain hole is shown in Fig. 4. The drain holes 28 are attached at the rear edge 30 of the worktop to a collecting line (not shown here) running horizontally, which line is connected to the refuse tank via a drainage line running vertically downwards (see Fig. 2). All the lines are preferably made from Teflon.

A section along the line V-V in Fig. 4 is illustrated schematically in Fig. 5. This Figure shows that the drain hole 28 is embedded in the worktop 3, 5 in each case and runs within it. The drain hole 28 is connected via drain channels 2 to the drain grooves 9. 10. An angular connection piece 31 is provided on the rear edge 30 of the worktop 3, 5 and is screwed into the drain hole 28 for example. The free end of this connection piece 31 is connected to the collecting line, not illustrated here in any greater detail, at the drainage line 12 represented in Fig. 2.

As illustrated in greater detail in Figs. 4 and 5, the connection piece 31 is present in a recess 32 on the rear edge 30 of the worktop 3, 5 in each case. Every connection piece 31 is thus accommodated in a well-protected fashion. It is clear that every worktop 3, 5 and also every part area 27 of the worktop concerned can exhibit one or more internally situated drain holes 28.

In accordance with a particularly preferred embodiment of the invention, the drain grooves 9, 10 are inclined towards the drain channel 2 in each case, and drainage lines 12 running more or less horizontally are inclined towards the refuse tank 13. This can be achieved, for example, in that the top of the worktop is slightly bulbous apart from its surface 8, in conjunction with which the lowest point is situated at the hole for the drain channel 2. It is also possible for the entire surface 8 of each worktop 3, 5, including the drain groove 9, 10, to be designed so that it is inclined slightly towards the drain channel 2 in each case. It is also possible for the drain grooves to be executed in such a way that their depth increases towards the drainage points. Each worktop 3, 5 can be a polypropylene sheet, for example.

A fluid flowing into the drain groove 9, 10, such as a solvent, is able in this way to flow easily and rapidly from the various drain grooves to the drain channel 2.

A ventilated laboratory cabinet 14 for fluid containers 15, preferably solvent containers, is present in the left-hand part of the laboratory trolley 4 beneath the at least one worktop 3, i.e. below the lower worktop 5 in the illustrative embodiment shown in Fig. 1. One of the fluid containers 15 is usually the aforementioned refuse tank 13. The laboratory cabinet 14 is made from a non-combustible material and has an earthed floor 16 made of stainless steel sheet. The risk of an electrostatic charge is reduced by this means. In Fig. 1 the drainage lines 12, which are routed in each case from the drain channel 2 into the cabinet 14 and to the fluid container 15 in each case, are omitted in the interests of greater clarity. The laboratory cabinet 14 exhibits two outward-opening doors 17, 18, of which the right-hand door 18 is capable of being locked by means of a locking device 19. Further storage space is provided next to the ventilated laboratory cabinet 14 on the floor 6 in the form of the low-level supporting construction, in conjunction with which a further cabinet intended to receive fluid containers, for example, is capable of being fitted here.

As previously mentioned, the extractor hood 7 is provided on the left-hand half of the upper worktop 3, which can be loaded with the various sample and fraction carriers via a charging opening 20. Instead of a charging opening, the extractor hood can also exhibit a front panel capable of being pushed upwards. A sliding door 21 is provided on the right-hand and left-hand side as well as the rear side of the extractor hood 7 in Fig. 1, via which door a means of access to the interior of the extractor hood is also possible. It is clear that both the extractor hood 7 and the ventilated laboratory cabinet 14 are connected to an exhaust air system that is not illustrated here in more detail.

In accordance with a particularly preferred illustrative embodiment of the invention, the laboratory equipment 1 can contain the previously already mentioned safety device 22, which is only indicated with broken lines in Fig. 1. The safety device is designed in such a way that it triggers an alarm in the event of a fluid flowing through the drain grooves 9, 10. In the alarm mode, the safety device 22 can interrupt the entire power supply for the laboratory equipment 1, for example, and is thus able to

prevent further fluid from leaking and flowing through the drain grooves 9, 10 and the drainage lines 12.

As illustrated in Fig. 1, the laboratory trolley 4 ultimately has three levels, namely the upper worktop 3, below it the lower worktop 5 and finally, below that, the floor 6 in the form of the low-level supporting construction for ventilated laboratory cabinets arranged below the top edges of the wheels 23. The supporting construction is open to the front, so that the one or more laboratory cabinets 14 can be placed inclined slightly forwards with their rear edge on the supporting construction and can then be pushed into the supporting construction without having to lift them completely. Similar embodiments are applicable to the fluid container 15 with reference to the laboratory cabinet 14 arranged on the floor 6 in each case. The two worktops 3, 5 are also provided on their periphery 26 with the drain grooves 9, 10 in accordance with the invention.

In the schematic front view in accordance with Fig. 2, the laboratory equipment 1 is illustrated only partially by comparison with the embodiment illustrated in Fig. 1. The cabinet 14 and the extractor hood 7 are omitted, for example. The drainage lines 12 extend in each case from the drain channel 2 through each worktop 3, 5, as previously mentioned, initially rearwards beneath the worktop in each case and then downwards, and finally discharge via a common line 24 into the fluid container 15, which is executed here as a refuse tank 13. Instead of the drainage lines 12 routed rearwards beneath the worktop in each case, drain holes 28 drilled into the worktop may be present, as previously described, which holes discharge into a collecting line running on the rear edge 30 of the worktop, which line is connected to the refuse tank 13 via a drainage line 12 leading downwards.

The extractor hood 7 is indicated only with broken lines in the top view of the laboratory equipment 1 in accordance with Fig. 3. The drain grooves 9 and 10 extend around the individual segment-like subdivisions 11. The drain channel 2 is present at an intersection between the drain grooves 9 and 10. It is clear that a plurality of drain channels can also be provided on each worktop. The drain grooves 9 and 10 as well as the segment-like subdivisions 11 are also present in the area of, and in particular beneath the extractor hood 7, as indicated in Fig. 3 partially with broken lines, so that

the safety device 22 (see Fig. 1) is also able to respond if a fluid flows into one of the drain grooves 9 or 10 in the area of the extractor hood 7 and makes its way from there to the drain channel and via the drainage lines 12 to the refuse tank 13.

It can be further appreciated from Fig. 3 that slots 25, for example for cables and lines, are present on the rear side of the worktop which is executed as a bench top.

It can be appreciated from the above description that a fluid flowing onto one of the worktops 3, 5 is able to spread only over the surface of a single segment-like subdivision 11, as it flows into one or a plurality of the drain grooves 9, 10 at the periphery of every subdivision. The fluid then flows via the drain grooves to the at least one drain channel 2 and from there, as already mentioned, via drain holes 28 and/or drainage lines 12 and into the refuse tank 13. A fluid escaping onto the worktops is prevented in this way from spreading in an uncontrolled fashion, whereby the risk of the formation of solvent vapours and/or explosive mixtures is greatly reduced.

A laboratory equipment has thus been made available, which is capable of being operated more safely.